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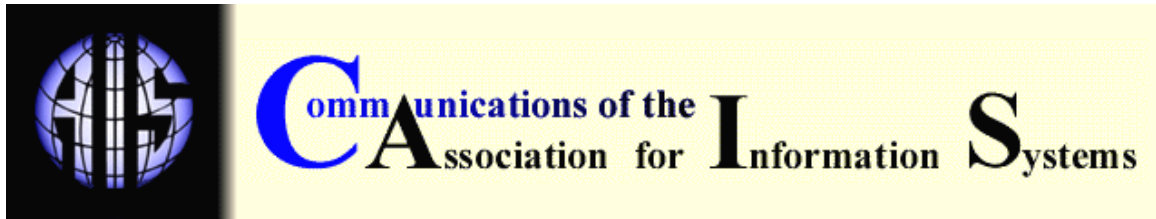
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COMPUTER SOFTWARE PATENTS: A DILEMMA IN COMPETITIVE ADVANTAGE IT RESEARCH

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ABSTRACT

A significant amount of information technology (IT) research centers on the attainment of competitive advantage through the use of IT. In many cases, the use of patents to protect that IT does not receive much attention. Often studies conclude that patent protection cannot help IT to achieve such an advantage. Our research finds that many IT researchers based these conclusions predominately on two studies that are no longer relevant. This paper reviews some of that IT research and then links that research to these two dated studies. A number of reasons why researchers may continue to use the research for support of their conclusions are put forth, including lack of knowledge, research as a lagging indicator, pressure to complete research. The paper offers recommendations for improving the research efforts such as using law as a reference discipline, considering the law in the reviewing process, and including legal considerations in doctoral training. We conclude with lessons learned.

KEYWORDS: IT research, IT competitive advantage, computer software patents, IT legal issues

I. INTRODUCTION

Intellectual property -- the umbrella term for patents, copyrights, trademarks, and trade secrets -- once was the backwater of American business. No more....Since 1983, Congress has quietly passed 14 laws strengthening intellectual property rights. Now companies are using those rights as potent competitive weapons....Until the 1980s, infringers had the edge. Courts tended to invalidate patents....Even when a patent holder won, the prize was usually just royalties from the infringer....In 1982, Congress created the U.S. Court of Appeals for the Federal Circuit in Washington, a court of last resort for patent cases....Under Chief Judge Howard T. Markey, an expert in patent law, the new court is upholding patents 80% of the time, vs. 30% under the previous system. "The Federal Circuit got the revolution going....Now business can count on patents to mean something." [Dwyer, 1989, pp. 78, 79]

Business method patents [that involve computer software] have the potential to influence significantly the direction and growth of the American economy. They

present a tremendous opportunity for inventive entrepreneurs, while at the same time presenting a critical economic threat to a wide range of businesses, especially those in service industries and e-Commerce [Guffey, 2000].

A considerable amount of information technology (IT) research investigating competitive advantage has been conducted since the early 1980s. This concentration of research is not surprising since IT and the information resource can and have made major differences in the success achieved by organizations. Two such firms are American Airlines/AMR Corporation and its SABRE system, and Wal-Mart with its retail logistics management activities and the wealth of information it possesses regarding its customers, their purchasing habits, and more. Noted IT research examples include Clemons [1986], Feeny and Ives [1990], Clemons and Row [1991], Kettinger et al. [1994], Sethi and King [1994], Mata et al. [1995], Brown et al. [1995], and Gunter and Butler [1999]. Watson et al. [1997] reported that using IT for competitive advantage is one of the most important issues among 11 studies conducted in the US, Australia, Europe, Hong Kong, India, and Taiwan.

Although the above list obviously does not encompass all IT research that examined competitive advantage, or all aspects of that topic, it is representative from at least one perspective. In each instance, any discussion dealing with intellectual property, specifically patents, is absent or not completely accurate. The research cited above is representative of this issue, and it is examined in Section III.

Patents on computer software are not new. The United States Patent and Trademark Office (USPTO) reports that computer software patents started gaining popularity in the early 1980s. More recently, business methods and applications dealing with financial, management, and cost/price determination were awarded in a fairly new patent class, class 705. Between January 1, 1996 and December 4, 2001, nearly 4,300 patents were awarded in that class [United States, 2000].

It is evident that organizations vigorously pursued patents on software applications for at least two decades. Recognition of this phenomenon, however, is not the case with regard to academic IT research. In this paper, we show that the disparity between research and practice led to questionable and perhaps erroneous conclusions surrounding some IT research. These conclusions are contrary to business practices, and would provide, at best, no assistance to the business community, or, at worst, subject businesses to crippling infringement litigation. It is also problematic that recent IT research continues to rely on dated empirical studies on the impact of patents, thereby aggravating the situation further.

We believe that this paper makes several contributions with regard to software patent issues. In Section II, we present a synopsis of the patent landscape as it relates to computer software, beginning in the early 1980s and continuing through today. In particular, we emphasize how patent protection became a common business strategy. In Section III we suggest that much IT research dealing with competitive advantage ignored many of these events, and we support this with analysis of numerous references in the IT literature. In so doing, we draw attention to non-IT research that we believe contributed to the position taken by IT researchers regarding software patents (Section IV). We use our findings to suggest causes for the problem, (Section V), to present potential solutions (Section VI) and to present a number of lessons to be learned (Section VII).

In the next section, we present a brief overview of patents and a review of some software-related patents that evolved since 1981. This review is important because it supports our position that patents on computer software were and continue to be important.

II. THE EVOLUTION OF SOFTWARE PATENTS

Patent protection in the US, which is provided for in the Constitution, is intended to promote innovation by providing financial incentives to inventors or their assignees and by granting exclusive rights to the invention. Like hardware, software is an invention for patent purposes. The rights granted to a patent holder include the right to exclude others from making, using, and selling the invention and the right to license others to make, use, or sell it for 20 years [Voet, 1995]. In return for this protection, the inventor is required to describe the invention and

the process of making and using it in sufficient detail so that those who are skilled in the relevant art are able to practice it. In addition, an invention must also be novel, meaning that it does not already exist, it must not be obvious, and it must be useful. Basically, the kinds of things that can be patented are either products or processes and any new and useful improvements on such products or processes. Software-related inventions are currently classified as process inventions. Patents are administered by the United States Patent and Trademark Office, which maintains a comprehensive web site at <http://www.uspto.gov>.

Throughout much of the 1970s, patents lost much of their appeal as a way to protect innovations. Then, in 1982 the US Congress created the US Court of Appeals for the Federal Circuit (CAFC), which was granted exclusive jurisdiction over patent appeals [Kastriner, 1991]. The primary motivation for the creation of the CAFC was to stabilize the application of patent law as administered by the Circuit Courts of Appeal, the predecessor to the CAFC for patent cases. Prior to the creation of the CAFC, many inconsistent interpretations and rulings were issued by the Courts of Appeal. The impact by the CAFC on patent litigation through enforcement was studied by Merz and Pace [1994]. Using data for the period from July 1971 through December 1991, their results indicate that a significant increasing trend in litigation occurred some time after April 1982, subsequent to the creation of the CAFC. Further, they theorize that the increase in enforceability and, thus, the value of patents may explain the increase in patent filings.

The patenting of computer software is highlighted by one of the more prominent examples in a case that went to the US Supreme Court in 1981. Referred to as the *Diamond v. Diehr* [1981] case, the US Supreme Court ruled that software could be patented even if an algorithm was involved as long as the algorithm was applied to a process. In this case, a process involving molding synthetic rubber into cured products included a computer application. Since the decision, patents on computer software have increased significantly. For the most part, patents on software are awarded based on three broad patent classifications: classes 364, 395, and, most recently, several classes between 700 – 717, dealing with data and information processing. Figures 1 and 2 provide more complete information for numbers of patents issued for many software-related classes¹. The 2001 data cover the period through September 11. A discussion of some noteworthy patent-related court cases follow these figures.

SOFTWARE PATENT EXAMPLES AND COURT CASES

One of the earliest and still one of the better examples involved the brokerage firm, Merrill Lynch. In this case in 1983, another brokerage firm, Paine Webber [1983], challenged the validity of the patent obtained by Merrill Lynch on its Cash Management Account (CMA). Paine Webber argued that the CMA patent was invalid and that the patent should not have been awarded in the first place. Paine Webber claimed that the patented method simply described a series of steps that could be carried out by hand with the aid of paper, pencil, and telephone. The Court held the patent valid, stating that the claims recited were patentable subject matter because they taught a method of operating a computer. At that time, Merrill Lynch sued Dean Witter for infringing on the patent. After validity was established, Dean Witter settled for \$1 million [Anonymous, 1983]. This case may have been instrumental in motivating organizations to invest in the development of in-house business-related IT, since the investment could now be protected from competitors if it is patented.

¹ Each patent class and subclass has its own title. Class 364 was titled Electrical Computers and Data Processing Systems. Class 364/400 was titled Applications; Class 364/401 was titled Business Practice and Management; subclasses /402, /403, and /404 were subordinate to subclass 401, and they were titled Inventory, Operations Research and With Cash Register, respectively; subclasses /406 – Accounting, /407 – Reservations, and /408 – Finance were also subordinate to subclass /401. Classes 705, 706, 707, and 717 each relate to Data Processing. Specific titles for them are: 705 - Data Processing: Financial, Business Practice, Management, or Cost/Price Determination; 706 – Artificial Intelligence; 707 – Database and File Management, Data Structures, or Document Processing; 717 – Software Development Installation and Management. For the most part, class 364 and related subclasses dealing with Electrical Computers and Data Processing Systems are no longer current classes. Relevant software patents would most likely be classified in classes 705, 706, 707, and 717. Class 395, Information Processing System Organization, was created in about 1991 from 10 former subclasses in class 364. It too is no longer a current class.

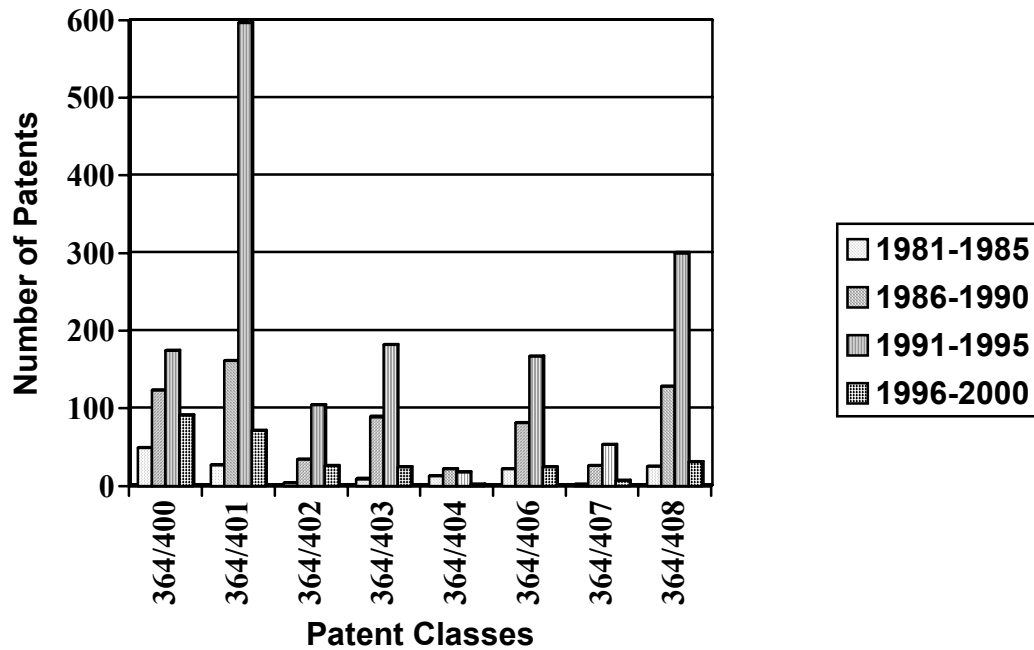


Figure 1. Numbers of Patents Awarded by Year, Classes 364/401 – 364/408

(Source: United States Patent and Trademark Office, <http://uspto.gov>). Current as of September 11, 2001).

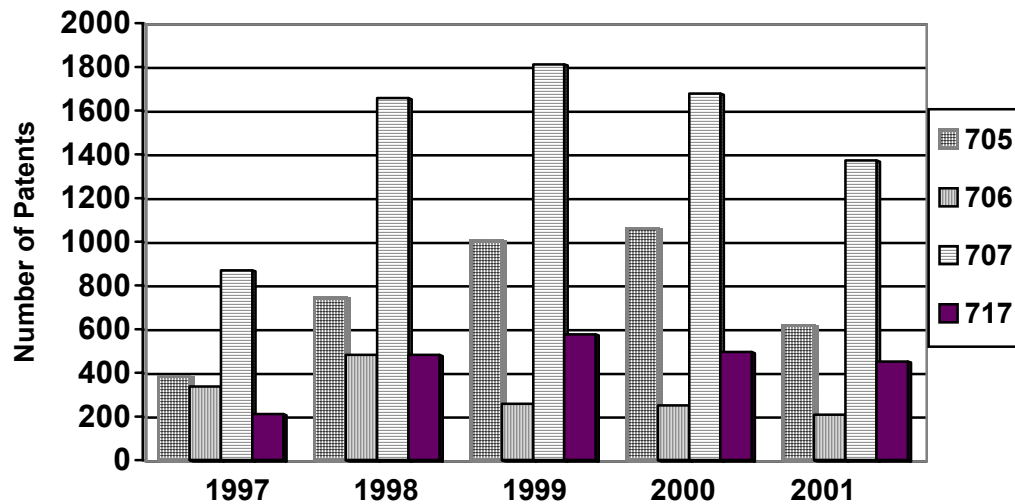


Figure 2. Number of Patents Awarded By Year, Classes 705-707

(Source: United States Patent and Trademark Office, <http://uspto.gov>). Current as of September 11, 2001

Other software patent cases found their way into the Court system. A more recent example occurred in 1994 between Microsoft Corporation and Stac Electronics. Stac owned a patent for data compression software. Subsequently, Stac and Microsoft entered into discussions whereby Microsoft would license the compression technology to include it in Microsoft's DOS 6.0 PC-based operating system. When negotiations broke down, Microsoft decided to use its own

technology. Stac then sued Microsoft for patent infringement. During the trial Microsoft tried in vain to have the patent declared invalid. Not only did Microsoft lose the case, the jury awarded Stac \$120 million in damages. Microsoft eventually bought Stac Electronics, purchasing 80% of Stac's stock [Anonymous, 2000].

A particularly interesting patent infringement action involving electronic commerce was filed by Amazon.Com against Barnesandnoble.com. In 1999, Amazon received a patent on a system that is referred to as its "1-click ordering system." Under this system and method, once a customer has provided certain information, e.g., credit card number, and shipping and billing information, the customer can check out easily and quickly on current and subsequent visits to Amazon.com. Not long after the patent was issued, Amazon.com sued Barnesandnoble.com for patent infringement. In December 1999, Amazon.com won a preliminary injunction against Barnesandnoble.com prohibiting it from employing its own "1-click ordering system," which was called "Express Lane" [Thurm and Quick, 1999]. In February 2001, the CAFC overturned the injunction, questioning the patent's validity. However, the case is still not decided completely in that it was scheduled for a full trial in Fall 2001.

Finally, one of the more important cases was State Street Bank and Trust versus Signature Financial Group [State Street, 1998]. In 1998 the CAFC ruled in favor of Signature Financial Group, the owner of a patented software application that implements an investment structure based on a "hub and spoke" approach. The application facilitates a structure in which mutual funds, which are the "spokes," pool their assets in an investment portfolio, which is the "hub." State Street Bank & Trust Company sued to have Signature's patent deemed invalid. State Street won its case at the District Court level, but lost the appeal. State Street took its case to the US Supreme Court, which refused to hear the case.

SUMMARY – SOFTWARE PATENTS

What is so important about the State Street case is that it "opened the doors" to obtaining patents on business methods involving computer software. Whole areas of business, such as the finance and insurance industries, which for the most part had not considered patents as viable options to protect intellectual property, must now do so. They can either stand by and do nothing while their competition acquires patents on software-based business methods, or they can become more aggressive. Based on the numbers of patents being issued in this categorization by the USPTO, it appears that the latter approach is predominant.

It would be impossible to identify all organizations that patented software applications. It can be stated, however, that the numbers are considerable. Noteworthy organizations include (the number of patents assigned to the organization is included in parentheses) Citicorp (8); SABRE (which includes SABRE Group and SABRE Decision Technologies) (22); Electronic Data Systems (107); MasterCard International (10); Citibank (46); Otis Elevator (7); and Merrill Lynch (25)².

The different organizations, the information regarding the number of patents listed above, and the information about noteworthy patent infringement cases are only representative of what exists in total. What is perplexing is why academic research, and IT research in particular, expresses the viewpoint that patents are not available for software, that they are difficult to obtain, that they don't mean anything anyway since anyone is free to copy, that one can just reverse engineer a patented application, and so on. The next section reviews briefly some of the IT research that dealt with software-related patent issues and the associated difficulties.

III. SOFTWARE PATENTS AND IT RESEARCH

A number of IT papers examine the issues surrounding IT and competitive advantage. The research is diverse, dealing with the development of frameworks and models, applying different reference disciplines, e.g., economics, testing new models as well as discussing the

² These organizations have more patents assigned to them than indicated. The applicable classes and, where appropriate, sub classes used to determine the number of patents are 364/400-364/408; all of class 395; and classes 705, 706, 707, and 717, including all sub classes for the last four. These classes and sub classes represent the majority of business-oriented applications. Data were obtained in September 2001.

relationship between competitive advantage and well-known models and frameworks. The research cited also spans more than 12 years, indicating that the issues addressed remain important. The common thread among all of these examples is that, in one way or another, software patents as a factor in achieving competitive advantage is either not addressed or is deemed inappropriate for various reasons.

CLEMONS AND KNEZ [1988]

In 1988 Clemons and Knez [1988] investigated innovations in IT research based in large part on economics. They raised a number of questions primarily related to the timing of an innovation, and they developed support for a more cooperative approach to IT development, an approach that would be shared by organizations within a particular industry. They state that there is an abundance of evidence that a follower can often match an innovation at considerably lower costs than the innovator, and they also state that innovative IT cannot be protected very easily through the use of patents, trade secrets, or proprietary technology. They do not provide references for these statements.

CLEMONS AND ROW [1991]

Clemons and Row [1991] investigated the role of tangible and intangible structural resource differences among firms and how these differences might contribute to sustaining a competitive advantage with IT. Intangible assets include patents. Clemons and Row state that imitation barriers and first mover advantages can be used to achieve a sustainable competitive advantage with IT, but they go on to indicate that these approaches are not very common. They indicate that patent protection for IT is almost non-existent, but no reference is cited.

KETTINGER ET AL. [1994]

Kettinger et al. [1994] developed a framework of factors affecting sustainable competitive advantage with IT, and they test it by evaluating longitudinal changes in performance measures of 30 firms that have been cited in the literature as using IT strategically, e.g., American Airlines and Merrill Lynch. They concluded that not all of the 30 firms were able to sustain a competitive advantage using IT. They found that, although technology is an important factor, managers must do more than just determine how unique or available an emerging technology is in developing strategic IT plans. Developing and moving innovations to market is another factor. They dismiss patents as a means to protect those IT investments, or in using those patented investments to further a sustained advantage with IT, indicating that "...it can be extraordinarily difficult to protect innovative applications of IT through patents ..." (page 34).

SETHI AND KING [1994]

Sethi and King [1994] conducted a field study involving 185 senior IS executives regarding IT projects and related factors that had been developed to achieve a competitive advantage. One factor, preemptiveness, included an item about barriers to protect the particular IT in question, including patents, copyrights, and trade secrets. Final analysis "... encourage[d] a pursuit of legal mechanisms to protect IT applications" (p. 1615), which include patents. However, they, argue that patents can be invented around and that legal costs to defend such protective measures are high.

MATA ET AL. [1995]

Mata et al. [1995] developed a sustainability model built around the resource-based view of the firm [Barney, 1991]. They include proprietary technology as a consideration for their model, and they did suggest that such technology could be protected through patents. However, they then argue that patents for IT applications are difficult to obtain and that patents do not provide much protection against imitation (page 497).

BETTIS AND HITT [1995]

Bettis and Hitt [1995] examined the nature and implications of changes in IT and their impact on being competitive in the 21st century. They theorize that IT diffusion should continue to increase, and they called for more research to learn how organizations might be successful competitively. They emphasize how important technology, innovation, and diffusion are, but they dismiss patent protection. In particular, they state that “software is difficult to protect and often readily available for competitors to study” (page 9).

SEGARS AND GROVER [1995]

Segars and Grover [1995] studied the strategic impact and technology-based competition on the structure of an industry. Their empirical study indicates that an IT-based innovation can change the dynamics of an industry, depending in part on whether other industry members match the innovation. They indicate that many IT-based strategic initiatives can be easily imitated, but they do not discuss patent protection.

SALMELA [1997]

Salmela [1997] examined the relation between information systems quality and sustainable business value. One of the conclusions was the importance of unique organizational resources and the fact that sustainable competitive advantage must be based on resources that are really unique such that other organizations cannot easily acquire them. Salmela [1997] indirectly dismissed patent protection for software, stating that “... information technology ... rarely constitute a unique resource” (page 823). This position is similar to that of Bettis and Hitt [1995].

WILKENS ET AL. [1997]

Wilkins et al. [1997] examined knowledge assets leading to a new framework to value and depreciate them. They suggest that the level of change in technology, such as expert systems, and the rate of innovation diffusion to competitors, can impact this process, but patents are dismissed by indicating that “... within 4 years of their introduction, 60% of the patented successful innovations were imitated” (page 71). This refers to research on patents conducted in 1981 and which does not relate at all to software.

JARVENPAA AND LEIDNER [1998]

Jarvenpaa and Leidner [1998] studied how an information provider firm in a developing country (Mexico) achieved competitive advantage in an environment that lacks much of the basic IT infrastructure and supporting information culture. Developed in part on the resource-based view of the firm [Barney, 1991], they state that a firm’s managerial skills, not IT, provide the basis for sustained competitive advantage. The use of IT-based patents is not addressed.

SHAPIRO [1999]

Shapiro [1999] examined the relationships between data-driven models for analyzing a firm’s strategic plans and the resource-based view of the firm. Shapiro did include legal resources, such as patents, as well as a number of other resources to consider. Similar to Jarvenpaa and Leidner [1998], he also indicates that IT resources are not sufficient for a firm to achieve a competitive advantage, and he states that legal resources can impact a firm’s competitive position by protecting a firm’s valuable resources (page 297). His position is much more positive than most other researchers regarding patents.

BHARADWAJ [2000]

Bharadwaj [2000] used the resource-based view of the firm in an empirical study of the association between IT capability and firm performance. On two occasions, she indicates that IT resources can be easily duplicated, thus concluding that IT can serve neither as a source of a competitive advantage nor as a source of a sustained competitive advantage. Protection by patents is not addressed.

SUMMARY

Our review of strategic advantage research suggests that software patents are not addressed adequately in the IT literature. What is not clear is why this perspective is so prevalent, especially given the significant attention to patenting by businesses. On the surface, it would not seem to make any sense in that IT researchers certainly want to provide industry with “cutting edge” research dealing with IT. Such is not the case with software and patents. Although there may be a number of reasons for this viewpoint, our research has revealed what we believe may be a predominant reason for this situation. That reason is addressed next.

IV. MANSFIELD, SCHWARTZ, AND WAGNER [1981]: THE REASON?

Mansfield et al. [1981], hereinafter referred to as MSW, published a paper in *The Economic Journal* entitled “Imitation Costs and Patents: An Empirical Study.” Their research was conducted to fill the need for empirical studies dealing with product innovations, as well as financial and time costs to imitate those products. In depth interviews involving major officials were conducted from firms in the chemical, drug, electronics, and machinery industries located in the Northeastern US that dealt with the cost and time of legally imitating 48 product innovations. At the time of the study, practically all of the innovations were major new products that were considered central to the innovating firms’ activities; perhaps the appropriate term in 2002 is that these products appeared to be part of the firms’ core business activities.

Among other things, the study involved an examination of imitation times, imitation costs, and ratios of imitation costs to innovation costs. It dealt very specifically with the relationships and effects of patents on imitation times and costs, and it examined what proportion of innovations would have been delayed or not introduced at all if they were not patented. As a barrier to entry MSW found that, contrary to popular opinion, patents did not make entry impossible and that within four years of the introduction of a new product, 60% of the patented successful innovations in their sample had been imitated. Still, they found that patent protection generally increased imitation costs but did not increase the costs enough to have an appreciable effect on the rate of entry. For about 15% of the innovations, patent protection was estimated to delay the time when the first imitators entered the market by about four years or more.

Regarding patents, MSW concluded that patents are, in essence, ineffective against copying and imitation, and they state further that in studies of optimal patent life, it was often assumed that a patent holder was free from imitation for the life of the patent and that, even though they understood how convenient such assumptions might be, their results suggested how considerably they depart from reality. Prior to 1981, which was the time the MSW survey was conducted, the results presented appear to be valid for that time. Flewellen [1981] also concurs with those findings, indicating that patents were an ineffective means of protection.

The MSW study and the publication of their results are important for several reasons from the perspective of our research. First, it reported on issues that were significant in the late 1970s and early 1980s. Second, it is important to mention that many of those issues are discussed and researched at great length today, often more than 20 years later. These include innovation [e.g., Rogers, 1983; Moore and Benbasat, 1991], adoption and diffusion [Rogers, 1983; Fichman, 1992], first-mover advantages and disadvantages [Lieberman and Montgomery, 1988; Feeny and Ives, 1990], and sustained competitive advantage [Feeny and Ives, 1990; Mata et al., 1995]. Those research thrusts continue to have strong parallels today.

Next, the MSW research is important to our analysis because it was completely unrelated to computer software. As stated above, it dealt mostly with the pharmaceutical and electronics industries. An ensuing question that might arise is, if the MSW research did not deal with IT in general and computer software in particular, then how is it relevant to our analysis?

To grasp the full picture of the relevance of that research to computer software and to its protection by patents, it is perhaps easier to think of how research in general is conducted. IT researchers often “borrow” from established reference disciplines, e.g., strategic management and cognitive psychology, to provide stronger theoretical and/or empirical support. This procedure is common, useful, and important. As long as the references to other disciplines are correct, there should be few problems. However, although the discipline itself may not be suspect, it is conceivable that reference to a particular study in a discipline could be problematic.

Such is the case with the MSW research and its relationship to current IT research and protection of IT using software patents. The study itself, when taken in the context of what has evolved regarding patents since the research was conducted, is dated, and it has led to invalid conclusions for today's IT environment. Yet, it is a study that we believe provides much of the support for why IT research efforts dismiss patent protection for computer software. Figure 3 depicts this perspective.

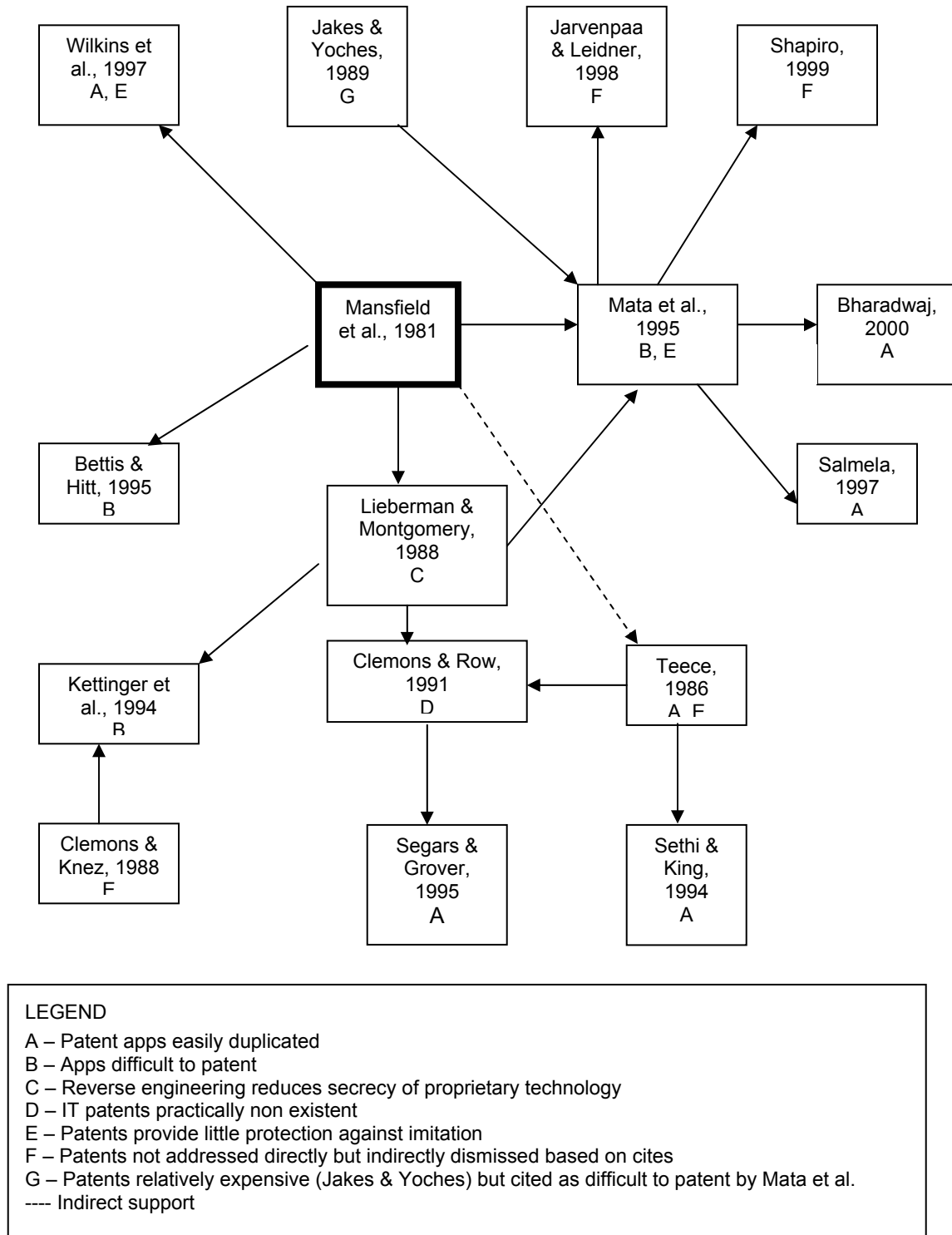


Figure 3. Impact of Mansfield et al., [1981] and Teece [1986]

Specifically, Figure 3 shows that the MSW research is essentially the beginning of many of the IT-related research problems concerning software patents. Recall that MSW dismisses patent protection for the most part because of its ineffectiveness. The figure also shows that some current researchers are now citing those who cited MSW, e.g., Mata et al. [1995] cited MSW, and Bharadwaj [2000] is citing Mata et al. [1995] to provide support for her position. As the process of "citing the citer" continues, there can be the tendency for incorrect information to be conveyed in a more indirect fashion. For example, Bharadwaj [2000] does not mention patent protection, but indirectly patent protection is not considered in that she states that IT resources can be fairly easily duplicated, supported by Mata et al. [1995].

The figure indicates that a number of points about patents are not correct. These include:

- Many of the researchers state that patented applications can be easily duplicated. This is not the case. Patent laws and court decisions support the position that one cannot make just minor changes in a patented application to avoid an infringement action based on copying. Substantial time and effort to develop an application that is not too similar as a patented one can be required.
- IT is difficult to patent. The evidence showing the number of software patents issued suggests otherwise. Furthermore, the USPTO continues to improve the evaluation process relevant to working with patent applications.
- Reverse engineering reduces the secrecy of proprietary technology. [Karas, 2001]. Patented software is protected against reverse engineering. In fact, Karas [2001] states also that developers of software applications may choose to patent different parts of an application while enforcing several patents at the same time.
- IT patents are practically non-existent. The thousands of IT-based patents dealing with software alone indicate that this simply is not true.

It is also important to address one other study, Teece [1986], shown in Figure 3. Although Teece [1986] does not cite MSW directly, later research by Teece [e.g., Jorde and Teece, 1990] does cite Mansfield et al. [1982]; it is interesting to note that Teece [1986] collaborated with Mansfield et al. [1982]. In that research Teece [1986] provides explanations for why innovating firms fail to achieve significant economic benefit from their innovations, while others, including imitators, do benefit. Teece [1986] states that innovating firms may not do well because patents can be invented around and that patents are especially ineffective at protecting process innovations. Most computer software is deemed a process innovation as far as patent protection is concerned. Teece's [1986] research is important because there are two direct references to it relative to our position in this paper: Sethi and King [1994] and Clemons and Row [1991].

A brief categorization of the research in Figure 3 is presented in Table 1.

V. POSSIBLE REASONS WHY IT RESEARCH EVOLVED AS IT DID

A number of issues and problems dealing with IT research and software patents were addressed in Section IV. These include misstatements about: patent effectiveness and patent availability. Too, some researchers have simply not addressed this type of protection for IT. Most of the concerns begin with the Mansfield et al. [1981] and Teece [1986] research and continue to 2000 as researchers cited the Mansfield et al. and Teece research and, subsequently, later researchers cite those who cited Mansfield et al. and Teece. The data presented earlier in the paper support the fact that organizations were receiving, and continue to receive, patents on software in general and, more recently, on software-based business methods, numbering in the thousands. Thus, why has research progressed in this manner? It is our opinion that a number of reasons are possible, and we discuss them below. They are presented as possibilities to be examined, not statements of fact.

Table 1. Relationship of IT Research on Competitive Advantage and Patents

STUDY	DATE	GENERAL THRUST	ATTITUDE TOWARD IT PATENTS	STUDY CITED
Mansfield et al.	1981	Cost and time to legally imitate 48 product innovations	Not addressed	
Teece	1986	Successes and failures by innovating firms	Not addressed	Mansfield et al., [1982]
Clemons & Knez	1988	IT innovations	Cannot protect innovative IT	Statements not supported
Clemons & Row	1991	Role of structural resources to sustain competitive advantage with IT	Patent protection for IT almost non-existent	Teece [1986]
Kettinger et al.	1994	Framework for sustainable competitive advantage with IT	Patents cannot protect software easily	Clemons & Knez [1988]; Lieberman & Montgomery [1988]
Sethi & King	1994	Develop instrument to measure sustainable competitive advantage with IT	Results showed legal mechanisms important, but patents dismissed	Teece [1986]
Mata et al.	1995	Developed sustainability model based on resource-based view of firm	IT difficult to patent; patents cannot protect IT easily	Mansfield et al. [1981]; Lieberman & Montgomery [1988]; Jakes & Yoches, 1989;
Bettis & Hitt	1995	IT changes and impact on being competitive	Patents dismissed	Mansfield et al. [1981]
Segars & Grover	1995	Impact of IT innovations and competition on industry structure	Patents not addressed but copying inferred	Clemons & Row [1991]
Salmela	1997	Relationship between IS quality and sustainable business value	Patents indirectly dismissed	Mata et al. [1995]; Kettinger et al. [1994]
Wilkens et al.	1997	New framework to value and depreciate knowledge assets	Difficult to protect innovations with patents	Mansfield et al. [1981]
Jarvenpaa & Leidner	1998	Achieving competitive advantage in developing country	Patents indirectly dismissed	Mata et al. [1995]
Shapiro	1999	Relationship between a firm's strategic plans and resource-based view of firm	Acknowledges patents exist but does not challenge others' statements of unimportance	Kettinger et al. [1994]; Mata et al. [1995]
Bharadwaj	2000	Relationship between IT capability and firm performance using resource-based view of firm	Patents not addressed	Clemons & Row [1991]; Mata et al. [1995]

LACK OF KNOWLEDGE

One very plausible reason is simply lack of knowledge. This reason may be especially true for research published in the early 1980s and continuing through the late 1980s to early 1990s. Recall that the US Supreme Court affirmed the validity of software patents in 1981, and the CAFC, dealing with patent appeals from US district courts, was not created until 1982. These events would not be what would be considered mainstream topics for IT researchers, so they most likely went unnoticed.

It is probably safe to assume that most IT academics are not attorneys, and therefore they would have little knowledge of the law in general and intellectual property in particular. In turn, they may see the area as lacking relevance to IT research. Thus, any discussion in research efforts that deals with the law might be minimal at best. Given that the MSW work was cited so frequently, it is easy to see why IT researchers might just gravitate to that source.

From about 1991, however, information about software patents was more widely available. This information included software patent lawsuits dealing with familiar organizations, e.g., Merrill Lynch and Paine Webber involving Merrill Lynch's CMA system [Paine Webber, 1983]; Quickview Systems and Apple Computer dealing with a method to display portions of multiple fields on a display screen [Whitmeyer, 1991], and lawsuits brought by Refac, International against Lotus Development Corporation and several other software developers involving patent infringements of spreadsheet applications [McAllister, 1989]. Most recently, i.e., late 1990s and beyond, organizations and researchers were confronted with substantially different times and environments brought on by such factors as intense competitive pressures, the Web, and electronic commerce. And software-based patent lawsuits were much in the news then too: AT&T Corporation v. Excel Communications, Inc. [AT&T, 1999] and State Street Bank v. Signature Financial Group [State Street, 1998] are representative.

Although information was available to IT researchers, the availability itself and its implications are complex. The Appendix lists examples of academic and legal research spanning nearly 20 years. It shows that other disciplines in addition to IT, e.g., economics and management, disregarded patents. However, it also indicates that a wealth of information was available from the legal community, information that would bring into question the views and assertions of academic researchers. One plausible explanation is that there are often long lead times between when an event occurs, i.e., patents on software, and its implications being researched and understood by a research community.

LAGGING INDICATOR

IT research is a lagging indicator. In many instances, two years or more may elapse between the time a research paper is completed and its publication. In addition, there is the time to do the study: research idea/question, literature review (which may be centered in IT research and, perhaps, in more recognized reference disciplines but most likely not in a discipline such as the law and probably not involving the business and popular press), data collection, data analysis, and completion of the writing. In effect, it is not inconceivable that even though at least three, and perhaps four or more, years could elapse from inception to print, the completed product reflects the conventional wisdom of the time that the study was begun.

PRESSURES TO RESEARCH

Most academics are under considerable pressure to conduct high quality research and to publish those results in respected scholarly journals. Indeed, tenure and promotion decisions often hang in the balance, based in large part on how many articles a faculty member published and/or how reputable the journals are in which the research appears. In the process, it is not inconceivable that published research may itself lack some rigor, perhaps by accident or, unfortunately, perhaps even by design. Time pressures and the number of available "acceptable" journals can be impediments. Thus, some may find it easier to cite research that supports their position without investigation into whether that research is correct, especially involving an area, such as IT and patents, in which they have little or no experience. A case study by Applegate and King [1999] highlights some of the problems IT researchers, especially new assistant professors, can encounter as research studies are conceived, developed, and implemented.

LACK OF INFORMATION

IT researchers may also believe that there is a lack of information available to them about the law. As such, it may be easier for them to, again, cite a work that is so often cited by many others. The fact remains, however, that IT and intellectual property issues are addressed to a considerable degree in the literature. For example, a search was made of ABI-Inform, ACM Digital Library, and Dow Jones using “information systems” and “intellectual property” as keywords covering the period 1990 - 2000³. Twenty-one articles were found in Dow Jones, 21 in the *Communications of the ACM*, and 493 in ABI-Inform. Limiting the ABI-Inform search to theoretical or conceptual studies or studies with statistical analyses reduced the number to 62. Clearly, the information is available and is sufficiently small in number that a single individual (and, perhaps their research assistant) can review it. In addition, the information presented in the Appendix supports further our assertion that information was readily available.

LAW IS UNIMPORTANT AND NOT RELEVANT

IT researchers may have the feeling that the law is unimportant or not relevant to their research. However, relevant is exactly what the law is. Consider just one aspect of IT today, electronic commerce. In 1999 the USPTO received at least 1,300 applications for business method patents [Angwin, 2000], a goodly number of them involving electronic commerce. In addition, Amazon.com's “1-click” patented ordering system is being challenged by Barnes&Noble.com Inc. as invalid, and a decision by the CAFC is forthcoming. If Amazon wins the case, it will send a clear signal to the business community that Internet and electronic commerce patents are most important and most likely long lasting [Stolley, 2000]. Furthermore, the increasing attention being raised between electronic commerce and trademarks surrounding cybersquatting and infringement of trademarks on web sites caught the attention of the court system and businesses alike [Silberlight, 2000].

Benbasat and Zmud [1999] state that the business community questions the practical relevance of information systems (IS) research that is published in the leading scholarly journals of the field. In raising relevance as a current issue, they pose questions, such as whether IS research can be applied by IT professionals in their jobs and whether the research focuses on current technological and business issues. In their view, the answer to these and associated questions was anything but positive. Indeed, with issues like electronic commerce, competitive advantage, sustained competitive advantage, and IT research that means something to the business community, it is hard not to see how the law, with special emphasis on intellectual property, is anything but relevant.

INTELLECTUAL CAPITAL DEEMED UNIMPORTANT

The emergence and investigation of knowledge management as an important concept related to strategic advantage in organizations has only recently received a significant amount of attention among IT researchers. Although organizations use knowledge differently, supporting the position that knowledge management in itself is not a new concept, the formal treatment of knowledge as an intellectual asset to be used to an organization's advantage is a new concept [Turban and Aronson, 2001]. Further still may be the lack of understanding that intellectual capital includes not only a company's human capital, it also is extremely important to understand that its intellectual property, such as patents, are also an integral part of the intellectual capital portfolio [Taylor, 2001].

³ The search was conducted in early October 2000, so the number of observations found would most likely change. *Communications of the ACM* was the only publication searched in ACM Digital Library. The search in Dow Jones was restricted to 12 MIS-related publications: *IBM Systems Journal*, *IEEE Transactions on Engineering Management*, *Information & Management*, *Information & Software Technology*, *Information Resources Management Journal*, *Information Society*, *Information Strategy: The Executive's Journal*, *Information Systems Management*, *Information Week*, *International Journal of Information Management*, *International Journal of Technology Management*, and *MIS Quarterly*.

VI. WHAT CAN AND SHOULD BE DONE?

It would seem that there are a number of shortcomings regarding the relationship between IT/competitive advantage and the protection of IT by software patents. An important question remains, however. What can be done?

THE LAW AS A REFERENCE DISCIPLINE

Every consideration should be given to developing the law as a reference discipline for IT research. Mykytyn and Mykytyn [2000] present an argument for this approach by examining three bodies of law that would have strong relevance to IT research: Those are contracts, torts, and intellectual property. Given the importance attributed to attaining and sustaining an IT-based competitive advantage, coupled with the dynamic legal environment, especially as concerned with software patents, it is crucial that research be presented that clearly and logically develops this idea.

LAW IN THE REVIEWING PROCESS

Another perspective concerns the journal review process. As stated previously, most IT researchers/reviewers are most likely not attorneys. Consequently, reviewers of papers, such as the research by Mata et al. [1995], Kettinger et al. [1994], and Sethi and King [1994], which relied either directly or indirectly on the MSW study, most likely did not question the positions taken about the inability to protect software by patents nor the ease with which patented software inventions could be duplicated. In effect, MSW became the conventional, unrefuted wisdom. If editors and reviewers lack this knowledge, then they are relying on the authors to, so to speak, police themselves with regard to the currency and applicability of citations. But since the authors generally lack the same knowledge, there is little reason to expect any difference in the research quality. What is essential, then, is a more complete profiling of current and potential reviewers so that areas of expertise can be more clearly and completely identified. As IT research continues to delve into more diverse areas of study, such as the law, it behooves editors, reviewers, and researchers to pay especially close attention to the facts that are presented. Incorporating the law as an IT reference discipline should help.

DOCTORAL TRAINING IN IT LAW

Another viewpoint concerns the research skills that are taught in IT doctoral programs. Most doctoral programs incorporate one or more seminars that delve into appropriate research techniques. However, do those techniques include something as specific as, and yet quite obvious as, checking the currency and accuracy of citations? Or is it just assumed that good research is based on such verification? Too often, perhaps, researchers may "find just what they want or need" to support a position and let it go at that. The legal literature, as evidenced by samples presented in the Appendix, provides a wealth of material available for research support, such that students would be able to acquire a richer understanding of proper review techniques related to the law and, for that matter, to other disciplines.

Furthermore, IT doctoral programs almost always include a number of research methods and research tools courses, e.g., ANOVA, multivariate statistics, experimental design, etc. With respect to the law as a reference discipline, consideration should also be given to including the law as a research tool, much in the same way as statistics and research methods are treated. Such a course could include relevant topics related to contracts, torts, and intellectual property, with particular emphasis on how these areas of the law can impact IT development and use. Initially, most institutions will have to hire adjuncts to teach this course until a reservoir of trained people becomes available.

VII. CONCLUSIONS

This paper elaborated on historical and current perspectives regarding software patents and IT research. It focused mainly on competitive advantage. For the most part, our research shows that there is a large difference between the attention industries give software patents and

the lack of attention by IT researchers to this way to protect and use IT assets competitively. We suggest that much of the IT research literature dealing with competitive advantage dismisses patents or does not treat them appropriately due, in large part, to two research studies that are not relevant today. We also suggest a number of reasons why IT research evolved in this manner, and we put forth some suggestions on how to ameliorate this situation.

We believe that there are a number of lessons to be learned:

1. IT is a social science, and unlike a hard scientific field such as physics, it cannot rely solely on a chain of references to support the position of researchers⁴. Situations change, the competitive landscape changes, and technology changes. Researchers must be more willing to investigate other disciplines, perhaps in this instance leading to the establishment of the law as an IT reference discipline.

2. Assumptions about practices such as reverse engineering are not correct in light of software patents and the nature of protection they afford. Often, the popular press may purport that a tactic such as reverse engineering can provide information about software applications without regard to the legal implications. Unfortunately, academic research may take the same perspective without questioning it.

3. The natural tendency of a reviewer or editor may be to pay no attention to the idea of software patents. As we said in Section VI, authors, reviewers, and editors are faced with the realities of publishing, and publishing quickly. If patents are mentioned at all, they may be treated as nuisances rather than a valid, fundamental question. Is it ignorance? Convenience? Perhaps both.

It is time to reconsider issues such as strategic advantage in a world where software patent protection can lock out innovation or make it much more difficult than before. It is time to investigate a number of related topics, such as first mover advantages, in a completely different light.

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1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
2. the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. the authors of the Web pages, not CAIS, are responsible for the accuracy of their content.
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APPENDIX. A TIMELINE OF RELEVANT ACADEMIC AND LEGAL LITERATURE AND EVENTS DEALING WITH SOFTWARE PATENTS (1981-2001)

YEAR	ACADEMIC LITERATURE	LEGAL LITERATURE
1981	Mansfield, Schwartz, and Wagner (MSW) – patents ineffective barriers against imitation	Diamond v. Diehr - US Supreme Court rules that software can be patented
1982		Court of Appeals for the Federal Circuit (CAFC) is created and granted exclusive jurisdiction over patent appeals
1983		Paine Webber v. Merrill Lynch lawsuit settled. Patent on Merrill's CMA system upheld
		Pavlak noted that CAFC rulings point to an increasing risk of a finding of willful patent infringement
1984		Meyer discussed the Paine Webber v. Merrill Lynch lawsuit and the patent's validity
		Gholz discusses the CAFC and its implications regarding willful patent infringement
1986	Levin found that many patents can be invented around, that others provide little protection, that many patents might not be valid, and that others are unenforceable because infringement is hard to prove	
	Ghemawat states that patents usually fail to deter imitation; cites MSW	
	Urban et al. state that patents can provide protection but often are ineffective because they can be "invented around;" cites MSW	
1986	Teece states that many patents can be invented around and that they are ineffective at protecting process innovations	
1988	Lieberman and Montgomery– citing MSW, state that first movers may be at a disadvantage and that imitating another firm's proprietary technology may be less than the cost to develop that technology	Process Patent Amendment Act – expands the definition of infringement
1990	Lawless and Fisher. – propose a framework dealing with competitive advantage and, citing MSW, note that followers may be better off than innovators	
1991		Kastriner – presents an historical perspective on patents; states that patents have become potent economic weapons and that competition requires obtaining them
1992	Hill states that patents widely used barriers to imitation but, citing MSW, states that patents often easy to invent around	Bender and Barkume– review issues related to software patents, the myths and realities of such issues, and the desirability of patent protection for software

YEAR	ACADEMIC LITERATURE	LEGAL LITERATURE
	Jacobson– citing MSW, concludes that managers place relatively little faith in the ability of patents to stop imitation	Meyer – notes that there are a smaller number of patent and enforcement issues in the software arts than in other technology areas; catalogs and discusses the most important of those issues
1992		The Advisory Commission on Patent Law Reform (A Report to the Secretary of Commerce) – reports on US patent law reforms; states that patents have been strengthened and have increased awareness internationally
1993		Siller and Retsky – presents an overview of intellectual property protection as it relates to IT; discusses specific aspects related to software
1994	Sethi and King, W.R. – state that patents can be invented around and that it is costly to defend patents; cite Teece [1986]	Carstens – reviews three basic forms of software protection: patents, copyrights, and trade secrets
		Kunin – reports on the increasing number of patent filings and issuances in software classes between 1988 and 1992
		Lech– argues that patents are best protection against reverse engineering
1995	Barney advocates reverse engineering; cites MSW in stating that patents mostly ineffective against imitation	Laurenson– discusses developments related to software patents
	Mata et al. – IT difficult to patent; citing MSW, there is evidence that patents offer little protection against imitation	
1996		Szepesi – addresses issues regarding which forms of protection to choose for software
1998		State Street v. Signature Financial Group – important decision by CAFC that business methods involving software can be patented
1999		AT&T Corp. v. Excel Communications, Inc. – CAFC upheld Excel's patent dealing with records for long distance telephoning
2000		Cantzler– argues for changes in the patent system to accommodate the unique needs of software; believes the decision in State Street v. Signature Financial Group is a step in the right direction

YEAR	ACADEMIC LITERATURE	LEGAL LITERATURE
2000		Guffey – discusses business method patents, indicating that they can create property of great value while warning that some businesses may incur substantial costs due to licensing or even infringement actions brought against them
2001	Rivkin– In proposing that a system's complexity can drive a wedge between the ease of replication by the owner firm in a different setting and the ease of duplication by rivals, states that patents guard against imitation only in limited circumstances.	Cohen, and Lemley– in supporting software patents, argues for patent law reform based on them

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